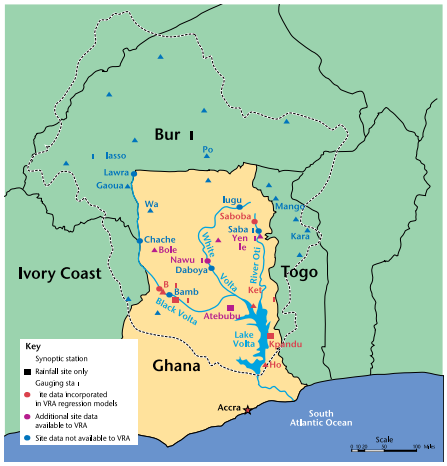
Seasonal prediction of water resources

Seasonal weather prediction can be a useful tool in environmental risk planning. For instance, farmers should be able to select the best choice of crop and management practice if they know, months or weeks in advance, the chances that the growing season will be drier or wetter than average. Development agencies should also be able to plan better where and when to stockpile essential short-term aid by anticipating shortages of food and water. There is also potential to infer flood risk, allowing emergency response teams to plan ahead to avoid the worst impacts.

Complex global models originally developed for weather forecasting and climate prediction are now routinely applied to seasonal global prediction in a number of global modelling centres around the world. They are able to provide risk information on seasonal climate fluctuations up to six months ahead in many parts of the world.

Currently, the forecasts tend to be better in the tropics than at mid latitudes, because the weather in the tropics is particularly dependent on slow variations of ocean conditions which are predictable up to six months ahead.

The Met Office Hadley Centre is developing new techniques to make the best use of all the available information to provide the most useful seasonal forecasts to inform decisions, for example through the Regional Climate Outlook Forums.



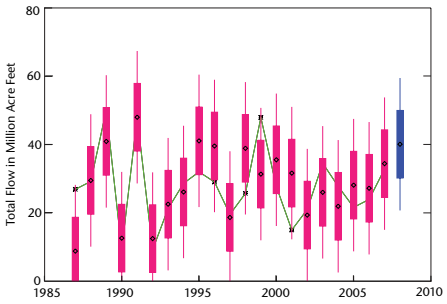


Figure: Top: location of Lake Volta. Above: forecasts from May of total lake inflow from June to November – best estimates (black circles) and confidence range (70% thick bars, 95% thin bars). Observations (green line) are also shown. The correlation of the best estimate prediction and observed inflows is 0.66. The forecasts for 1987–2000 were made retrospectively. The small sample of real-time forecasts since 2001 indicates that the 70% confidence interval is realistic – the observed flow is inside the confidence interval on all but one occasion. June to November 2008 prediction is shown in blue.

PREDICTION OF RIVER FLOW FOR POWER GENERATION

Met Office Hadley Centre seasonal predictions, issued before the rainy season begins, give good forecasts for the accumulated rainfall over large river catchments in parts of West Africa. We have made practical use of this capability to predict water volume inflow into Lake Volta, Ghana. This work is being used by the Volta River Authority (VRA) for aiding management of hydro-electricity generation.

"The lake inflow prediction system we have set up with the Met Office Hadley Centre forms an integral part of our annual planning for hydro-electric generation capacity."

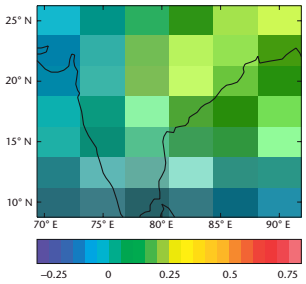
Kwaku Wiafe
Senior Civil Engineer, VRA

PREDICTION OF THE INDIAN MONSOON

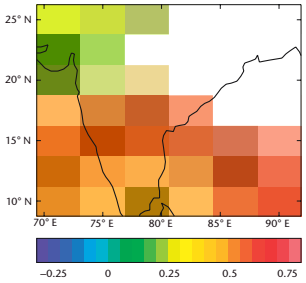
The Indian summer monsoon is vital to many aspects of life in India, but has always been difficult to predict. Good predictions of rainfall for the monsoon season could be used to anticipate drought and floods and aid in agricultural planning.

Traditionally, statistical methods based on observations before the forecast period have been used as a relatively cheap forecasting tool for India; however, these predictions provide little useful information. More recently, complex global dynamical models have become available, but their forecasts also contain little useful information on monsoon rainfall (see Figure Upper). The models provide better forecasts in other parts of the world, for example in the tropical Pacific. However, the weather in the tropical Pacific and the Indian subcontinent are strongly connected.

The Met Office Hadley Centre has developed a new statistical-dynamical approach to improve the forecasts by calibrating them – combining the good forecasts in the Pacific with knowledge of the strong connection with India in order to provide better forecasts for the Indian subcontinent. This improves the forecast of rainfall in southern and central India during the monsoon (see Figure Lower). The next stage is to give planners access to the information to see how useful it is.



Standard system



Improved system

Figure: The skill of seasonal predictions (measured by the anomaly correlation coefficient). Positive values mean that the predictions contain more useful information than climatology, and negative that they contain less. A value of 1 would indicate that the forecast was perfect. Figure Upper: standard system. Figure Lower: improved system. Areas are masked out where the skill is lower in the new system than in the standard system.

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